ACC DSM Workshop February 13, 2004

Proposed Program Development
For
UNS Electric



\$60,834	52	0.0	2,589	TOTAL			
	ed to	will be generat	rams. Routine reports will be generated to SM reports.	energy savings for programs. -annual and year-end DSM re	It will be necessary to create a database to meausure and verify energy savings for programs. Rout determine energy savings, and TEP will report results in its semi-annual and year-end DSM reports.	It will be necessary to create a c determine energy savings, and	Measurement and Verification
		0.0	44	See Note 1	Societal test	Weatherization of homes for low Societal test income customers	Low-Income Weatherization of I
\$12,500	40	0.0	2,500	МТ	No defined measures.	On-line energy audit with bill history download	On-Line Energy Advisor
\$5,000	60	0.0	NA	Feasibility - high	МТ	Trade shows - energy conservation information	Customer Education
\$33,334	51.50	0.027 51	45	Feasibility - high	Societal test	\$500 Rebate to replace an existing HVAC unit.	Residential HVAC Program
\$10,000		0.0		Feasibility - high	No defined measures.	Education programs for K-12 schools. (Energy Patrol)	Academic Education
Est Annual Spending (\$,000)	Est Annual E Savings S (MWH)	Est Annual Es Savings Sa (MW) (M	Participants (est #/yr)	Other Considerations (Feasibility, market share, MT effect)	DSM Measures	Description	Program Name
			ential Segment	ctric - New Residenti	DSM Workshop Proposal UNS Electric - New Resid	DSM Works	

	0.1	258	TOTAL			
	s will be gene). Routine report eports.	energy savings for programs -annual and year-end DSM re	atabase to meausure and verify TEP will report results in its semi	It will be necessary to create a database to meausure and verify energy savings for programs. Routine reports will be generated to determine energy savings, and TEP will report results in its semi-annual and year-end DSM reports.	Measurement and Verification
171.0	0.095	95	Feasibility - high	Societal test	Rebates (\$500) are offered for installation of unitary air conditioners, heat pumps, and chillers.	Commercial HVAC Program
0	0.0	100	Feasibility - high	No defined measures	On-line energy audit with bill No defined measures download history	On-Line Energy Audit
34.0	0.019	63	Feasibility - high	Societal test	Rebates up to \$500 per customer are offered for the installation of efficient lighting systems in new and existing facilities.	C&I Lighting Program
Est Ann Savings (MWH)	Savings Savings Spending (MW) (MVVH) (\$,000)	Participants (est #/yr)	Other Considerations (Feasibility, market share, MT effect)	DSM Measures	Description	Program Name
#	ป Segmen	al/Institutional Segment	nmercial/Industrial/I	DSM Workshop Proposal UNS Electric - Commercial/Industri	DSM Workshop Propo	

spending per liretime kvvn savings (\$/kvvh)	Spending per annual KVVn savings (\$/kVVh)	opending per NVV peak savings (\$/KVV)	Sponding por I/W pool on the (##WW)	COST EFFECTIVENESS (IIIWII)	Commercial/Industrial/Institutional	Residential New Construction	Existing Residential/Low Income	Annual Energy Savings (mWh)	Cumulative Annual Effect (mWh)	Commercial/Industrial/Institutional	Residential New Construction	Existing Residential/Low Income	Annual Peak Demand Savings (mW)	Cumulative Annual Effect (mW)	ENERGY/DEMAND SAVINGS	Expenditure Impact on Rates (%)	Commercial/Industrial/Institutional	Residential New Construction	Existing Residential/Low Income	lotal USM Spending (\$,000)	USM SPENDING	
#DIV/0!	682	1,241,135	1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		205	52	0	257	257	0.1	0.0	0.0	0.1	0.1			\$114,166	\$60,834	\$0	\$175,000	2005	De
#DIV/0!	682	.241,135 1,241,135 1,241,135 1,241,135 1,241,135 1,241,135 1,241,135 1,241,135 1,241,135			205	52	0	257	513	0.1	0.0	0.0	0.1	0.3			\$114,166	\$60,834	\$0	\$175,000 \$175,000 \$175,000	2006	DSM Workshop - Proposed DSM Portfolio UNS Electric
#DIV/0!	682	1,241,135			205	52	0	257	770	0.1	0.0	0.0	0.1	0.4				\$60,834	\$0	\$175,000	2007	hop - Pro
#DIV/0!	682	1,241,135			205	52	0	257	1,026	0.1	0.0	0.0	0.1	0.6			$\overline{}$	\$60,834	\$0		2008	posed D
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#DIV/0!	682	1,241,135			205	52	0	257	1,539	0.1	0.0	0.0	0.1	0.8				\$60,834	\$0	\$175,000	2010	folio UNS
#DIV/0!	682	1,241,135			205	52	0	257	1,796	0.1	0.0	0.0	0.1	1.0				\$60,834	\$0	\$175,000	2011	S Electric
#DIV/0!	682	1,241,135			205	52	0	257	2,052	0.1	0.0	0.0	0.1	=			\$114,166	\$60,834	\$0	\$175,000	2012	
#DIV/0!	682	1,241,135			205	52	0	257	2,309	0.1	0.0	0.0	0.1	1.3			\$114.166		\$0	\$175,000	2013	
#DIV/0!	682	1,241,135			205	52	0	257	2,565	0.1	0.0	0.0	0.1	1.4			\$114.166	\$60.834	\$0	\$175,000	2014	
#DIV/0!	682				205	52	0	257	2,822	0.1	0.0	0.0	0.1	1.6			14,166 \$114,166 \$114,166 \$114,166 \$114,166 \$1,255,826	\$60.834	\$0	75,000 \$175,000 \$175,000 \$175,000 \$175,000 \$1.925.000	2015	
#DIV/0!	682	1,241,135	Average			1,000			2,822					1.6		1100,000	\$1 255 826	\$669 174	\$0	\$1.925.000	2015 TOTAL	



Commercial Solar HVAC

- Solar assisted HVAC, using ad/absorption chillers, is becoming common in Europe.
- For example, So Cool Energy, Inc. (an Arizona company) utilizes technology that has been deployed in Europe since 1992 for DHW and space heating and since 2001 for air conditioning. Each of our projects is guaranteed to reduce the consumption of fossil fuel for DHW and HVAC purposes by over 60 %, for a net cost savings of up to 20%.
- So Cool's technology alone currently accounts for 7 out of the 35 largest solar plants worldwide in the last 5 years. Project sizes range from 1,000 to 200,000 square feet.
- companies developing this technology There are numerous other foreign companies and a few U.S.



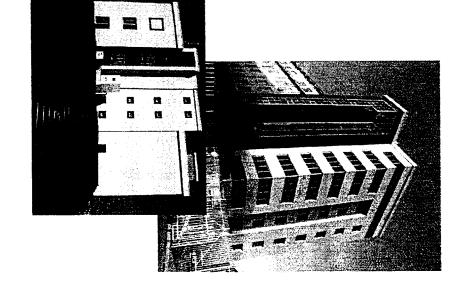
The Arnold Schwarzenegger Stadium in Graz, Austria

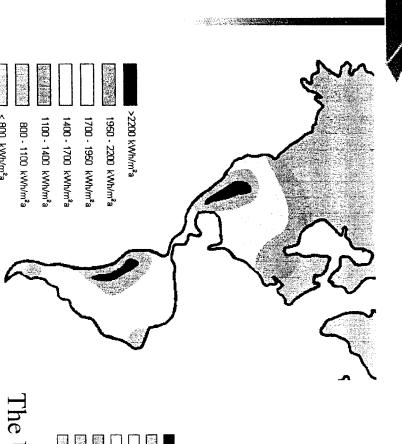


Solar HVAC Case Study

for Reconstruction in Kosovo Office building for European Agency

- 25,300 sq ft, nine story building
- 2,500 sq ft of solar collectors Cooling load 108 kW/30 tons Heating load 170 kW
- requirements of heating, and 100% of hot water Solar covers 75% of cooling, 20%
- Operational March 2003 Rebuilt in 2002/2003





>2200 kWh/m²a

1950 - 2200 kWh/m²a 1700 - 1950 kWh/m²a 1400 - 1700 kWh/m³a 1100 - 1400 kWh/m³a

800 - 1100 kWh/m²a

U.S. Potential is Huge

The U.S., especially in the Southwest, has a tremendous solar resource. Austria has solar radiation comparable to southern Alaska.



European Union Advances*

- Solar Thermal Growth in the 1990s 13.6%
- Employs over 80,000

(Total population = 200 million)

- Total Square Footage at the end of 2003 165 million (Per 1,000 capita - 850 square feet)
- Goal for 2020 for all Renewables 20%

Solar thermal is expected to occupy almost 2% of the total renewable market compared to its current 0.02%

- Projected additional employment for solar thermal is 200,000
- cooling will help to increase the market share." In Europe, "extension to large scale applications and heating and

Thermal Industry Federation Sources - European Conference for Renewable Energy, January 2004; European Solar



Energy Efficiency Opportunity

Solar Plus Energy Efficiency

- SWEEP has pointed out the benefits of energy efficiency
- both sectors Solar, combined with energy efficiency measures, can increase
- Current cost of Commercial Solar HVAC \$.50-\$1.50 per watt

Energy Service Performance Contracting for Solar HVAC

- Energy provider plans, constructs, and finances the facilities
- share the long-term savings over a 15-20 year fixed-price contract. In required by the customer some instances, such as with So Cool, zero capital investment is With a small customer down-payment, the provider and customer
- The energy savings are guaranteed.

APS Proposal for Cost Effective DSM Policy

DSM Workshop 2/13/04 Tom Hines



Energy Efficiency in Arizona

- Spending does not equal results
- Arizona has been held up as an example of a market based approach to energy efficiency
 - ☐2002 National Energy and Environmental Building Association conference
 - □Energy Star awards

How Efficient Are We?

Arizona is ahead of the nation in many ways

Phoenix leads nation in guaranteed heating/cooling and Energy Star homes
 Low E windows - 50% market penetration

 Approximately 90% of replacement HVAC market is 12 SEER or higher

Much newer building stock than most states
 Active ESCO market

So What's Driving Arizona's Load Growth?

- Population and economic growth
- Larger homes
 - ☐More energy efficient, but larger
 - □ Average square footage increase of more than 20% since 1980's

- More consumer electronic devices
 - □Computers, cell phones, DVD's, etc.
- More business office equipment

Developing Program Ideas

Program Considerations

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- APS experience/program history
- · Other utility programs
- SWEEP recommendations
- Market transformation opportunities

Program Considerations

- Diversity of programs
- Cost effectiveness
- Equity
- Customer interest/acceptance
- Demand and energy savings
 Saving peak demand is key

Proposed DSM Programs

Residential New Construction

- Already achieving significant results
- Increase funding to:
 - □Increase market penetration of Performance Built Homes
 - □Conduct additional building science training
 - □Expand outside metro area

Residential Existing Homes

- Expand existing successful programs
 - ☐ Qualified Contractor program
 - □On-line audit (add functionality)
- Home performance tests
 ☐Energy Management Council contractors
- New educational campaign to promote high efficiency AC (co-op advertising)
- TOU education
- Explore pilot of direct load control

Low Income Weatherization

- Expand existing program
- Increase funding limit per household
- Raise minimum income requirements
- Remove restriction for owner-occupied housing

Commercial/Industrial/Institutional

- Continue/expand current programs
 □APS Power Partners
 □Building Operator Certificate
- Energy Profile Info/Demand Response
- · Cool Roofs program
- Design Assistance/Building Science Seminars (target schools)
- Partner/Sponsor US Green Building Council and LEEDS certification

Measurement and Evaluation

- Existing Residential —
 □Follow up to MT baseline surveys
 □Qualified Contractor phone customer surveys
 □Home performance test results
- Commercial —
 □Building Operator follow-up
 □MT baseline and follow-up surveys

DSM Policy Recommendations

- Utilities:
 - ☐MT approach works expand existing MT efforts and add new MT programs
- Legislative:
 - ☐State and municipal buildings
 - Clarification on shared savings
 - □Commercial building energy code
 - More cost effective and equitable
 - Explore a commercial code

DSM Proposal Summary

- Funding level of \$3 million
- Estimated annual savings =

 ☐44.7 MW peak demand

 ☐102,690 MWH energy

16

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		nates.	preliminary estin	entive. All savings shown are p	NOTE: Estimated spending levels do not include net lost revenue or any other financial incentive. All savings shown are preliminary estimates	ing levels do not include net lost	NOTE: Estimated spendi
\$500	32,400	18.9	15,600	TOTAL			
\$30		builders offer a using by EPA! Energy Star a	y. In addition, be house in addition, be house it area hour ord construction,	performance prior to occupanc ant study being conducted on F ge differences between standa	For residential new construction, homes are being field tested for performance prior to occupancy. In addition, builders offer a written guarantee of performance. Additional M&V will result from a current study being conducted on Phoenix area housing by EPA/Advanced Energy. APS is participating in this study to determine actual usage differences between standard construction, Energy Star and guaranteed homes.	For residential new construction guarantee of performance. Add Energy. APS is participating in guaranteed homes.	Measurement and Verification
9300		11.2	4,500	 Significant construction improvements All are Energy Star plus performance More branding could achieve higher penetration 	Compared to typical homes, package of measures includes low E windows, downsized AC, better insulation/air barrier, tight envelope/ducts, advanced framing, pressure balancing, ventilation	 Successful program with significant results Currently limited promotion – expand recognition Expand to growth areas outside Phoenix 	Performance Built Home Program (expanded)
\$120				ders	Promotes building science Principles to builders. Measures influences many homes induertaken include improved insulation, framing, air barrier, duct sealing, etc. • Each training session • Highly cost effective • Good persistence, building science • Good persistence, building science	Building Science Highly successful training that Training/Infrared has produced results Research/Improved Duct Still significant ongoing need Additional training in metro area and expand to rural areas	Building Science Training/Infrared Research/Improved Duct Sealing (expanded)
Est Annual Spending (\$,000)	nual	Est Annual Savings (MW)	pants	e a	DSM Workshop Proposal (APS) - New Residential Other Considerations (Feasibility, market shared MT effect)	Description Daw Wo	Program Name
			oamont t	Now Posidontial S	riches Dreses (ADS)	Dem W/	

Program Name Description Expand existing low income weatherization program increase limit on funding per household income requirements Remove restriction on owner-occupied housing Expand functions of EnergyGuide acid: Education* Expand functions of EnergyGuide acid: Education income requirements Remove restriction on owner-occupied housing Expand functions of EnergyGuide acid: Education income requirements Remove restriction on owner-occupied housing Expand functions of EnergyGuide acid: Education income requirements Promote home comfort/efficiency tests Energy Mgmt Council – blower door, duct blaster, infrared, flowhoods in the contractors and manufacturers training/marketing for contractors. Fromotion Produce educational campaign with contractors and manufacturers in the contractors who meet strict standard and promotional campaign ourses. TOU Program/Promotion Current MT program - provides customer referrals to HVAC contractors who meet strict standard and participate in energy efficiency training courses. TOU Program/Promotion APS currently has one of the most successful TOU programs in the country with over 300,000 participar and participar in the country with over 300,000 participar and participar in the country with over 300,000 participar and participar in the country with over 300,000 participar and participar in the country with over 300,000 participar and participar in the country with over 300,000 participar and participar in the country with over 300,000 participar and participar in the country with over 300,000 participar and participar in the country with over 300,000 participar and participar in the country with over 300,000 participar and participar in the country with over 300,000 participar and participar in the country with over 300,000 participar and participar in the country with over 300,000 participar and participar in the country with over 300,000 participar and participar in the country with over 300,000 participar and participar in the country in program in the count	OSM Workshop	DSM Workshop Proposal (APS) - E	Existing Res/Low Income Segmen	1	<u> </u>	Est Annual I	Est Annual
cation* information tractor tractor tractor tractor tractor	D	DSM Measures	Other Considerations P (Feasibility, market share, MT effect) (F	licipants #/yr)	rings V)		Spending (\$,000)
o o o o o o o o o o o o o o o o o o o	come		<u> </u>	780	0.3	,039	\$700
	ousehold	repair/upgrades, some appliances	Targets customers in need of assistance Increased funding limits allow AC replacement, other significant upgrades				
on to the contract of the cont		MT/Education campaign	EnergyGuide used in several western 8	8,840	0.8	2,546	\$180
oad on on one of the original		int of	9. <u>B</u>				
oad otion a second seco	ls into Spanish		energy products store, etc. Ability to expand reach to Spanish speaking customers (% of customer base)				
Contractor gram/Promotion gram/Contractor	cy loor,	Measures will vary depend on home diagnostics. May include reducing duct leakage, adding insulation, pressure balancing, HVAC repair or replacement, windows/shading, other measures.	Used in several utilities nationwide Promotes market for diagnostic services Ability to target customers with comfort Issues and high bills Targets poor performing existing housing stock				99 00
Contractor gram/Promotion Direct AC Load	SEER and aign with acturers materials and	Replacement of existing HVAC equipment with high efficiency.	 Addresses largest end use Energy and peak demand savings Federal standards increase to 12/13 SEER in 2006 As available SEER has increased, higher SEER is less expensive and more cost effective for customers 	19,712	4.2	25,689	\$200
	des standards ficiency	Repair/tune-up/replacement of existing HVAC equipment and duct system.	gram. APS ustomer	6,000	0.2	360	\$100
Direct AC Load	ints.	Promotion to help existing TOU customers get the best value from their rate.	Existing successful program that saves peak demand. Nevada is undertaking a similar TOU education campaign.	18,000	11.7	0	\$70
	Explore potential for a pilot program AC compressor/thermostal controls "Next generation" improved controls	Direct utility control of home HVAC system during peak load periods.	 Reduces peak demand Dispatchable Utah, Colorado, many other states 	100	0.2	0	\$100
Measurement and No M&V proposed influence on marke work performed. F	d for low income comp (et barriers and custor	oonent. For existing resident mer and market player aware e testing, sample test results	No M&V proposed for low income component. For existing residential consumer education and M1 programs, conduct periodic surveys to gauge influence on market barriers and customer and market player awareness levels. For Qualified Contractor program, conduct phone surveys to identify work performed. For home performance testing, sample test results from participating contractors.	m, conduct p	hone surveys	gauge to identify	6

17.6

29,831

\$1,500

	DSM Workshop F	roposal (APS) - Comme	DSM Workshop Proposal (APS) - Commercial/Industrial/Institutional	nal Segment	라		
			Other Considerations	Participants	Est Annual Savings	Est Annual I Savings	Est Annual Spending
	Next-day load profile and analysis (large C&I)	sures will		,			\$150
Information and Demand Response	(large C&I) • Help customers operate buildings most efficiently • Provide training and education • Combine with demand response program – provides incentives to customers for curtailing load on peak days	result from better understanding of facility energy demand and consumption. Better load management, identification and replacement of inefficient equipment, improved operations and maintenance, better energy controls.	Load profiles show opportunities for savings Reduces demand/can be focused on peak demand Provides value for customers, easily adopted Helps existing facilities become more efficient				
Cool Roofs Program	Cool roofs could be promoted without incentives Light colored, reflective materials—little or no extra cost Education programs/materials for commercial customers Offer training for building trades and roofing companies Partner with manufacturers and	Promotes use of cool roofing materials to reduce building cooling loads.	Successful in other warm/hot climates Reduces energy use and peak demand Recommended in SWEEP report Cost effective	1,000	0.2	12,364	\$150
Institute for Facility Management Education	New MT program for 2003 that provides commercial energy management education Targeted to building operators and facility managers Two 8 week courses and individual classes Partnered with Electric League and Anzona Energy Office	Combination of measures will result from better understanding of facility energy demand and consumption. Better load management, identification and replacement of inefficient equipment, improved operations and maintenance, better energy controls.	Successful in other states, good survey results from students to date Additional funding needed to: Increase promotion/attendance Improve training facility Provide additional materials Pay for expert instructors/field visits Subsidize expenses to attract students	100	2.2	10,000	\$80
Design Assistance	 Training seminars for commercial builders/designers Energy simulations to show benefits of efficient specs Use building science/systems approach 	Work with building designers during new construction and major renovations to specify more efficient thermal envelope, mechanical systems and equipment.	Utah, Nevada, other regional states Targets customers at point where they can make the most cost- effective changes Saves energy and peak demand	သိ	1.2	4,940	\$ 250
Energy Efficient Schools Program	 Program targeted to help public schools reduce their operating costs Excess utility pool of funds to expire by 2008 Seminars, targeted training materials Consider incentives 	Demonstration projects, training and design assistance targeted to schools. Will result in a variety of measures including improvements to envelope, mechanical systems and operations/building controls.	Saves energy and helps schools meet budgets Represents over 800 large facilities in APS territory Arizona Energy Office/ASU partnerships	85	0.1	3,655	\$250
Power Partners	Existing program developed in conjunction with governor's summer 2001 conservation campaign. Voluntary C&I curtailment program for summer days that exceed 110 degrees	Participants pledge to turn up thermostats, turn-off unneccessary lights and equipment, and shift the timing of energy-intensive tasks.	Continues an existing successful y program.	100	0.2		\$ 20
Measurement and Verification	Follow-up surveys for all building operator students to determine actions taken, load profile analysis and true-up for energy profile/demand response, sample modeling done for design assistance and cool roofs, ASU analysis for schools projects, survey for Power Partners participants, MT baseline and follow-up surveys to determine market barriers and awareness.	tor students to determine actions ta tance and cool roofs, ASU analysis barriers and awareness.	ken, load profile analysis and true-up to for schools projects, survey for Power	for energy profi Partners partic	le/demand res sipants, MT ba		\$100

1,348

8.2

40,459

\$1,000